ADVANCE DATABASE SYSTEMS DEVELOPMENT [CC6001]

WEEK - 04

Database Recovery II

Definition

Database Recovery is the process of RESTORING the database to the MOST RECENT CONSISTENT STATE that EXISTED Just before the FAILURE

Definition

"restore database to a stable that is **known** to be correct after some failure has rendered current state incorrect or at least **suspect**"

Types of Failures Contd..

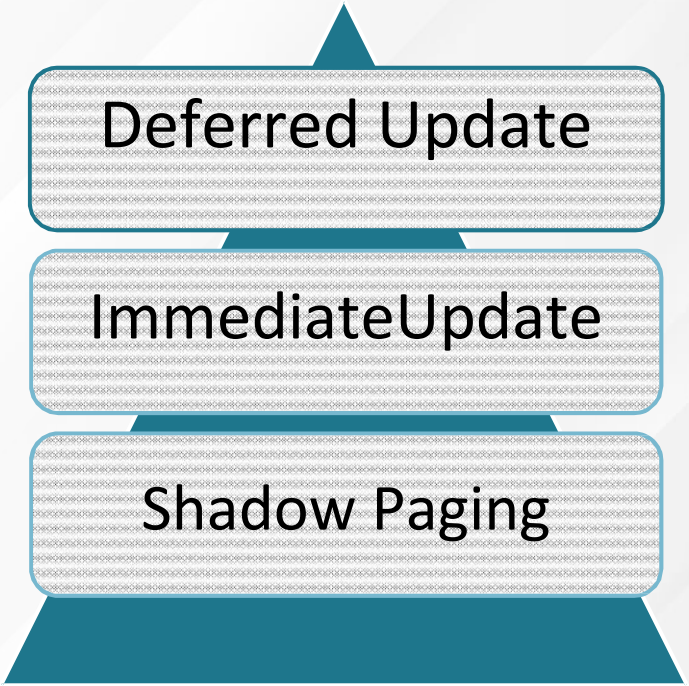
- Transaction Failure
- Media Failure
- System Failure

Recovery – System Failure

Will affect ALL TRANSACTIONS currently in PROGRESS but NOT database itself.

System recovery is carried out as part of system's restart procedure.

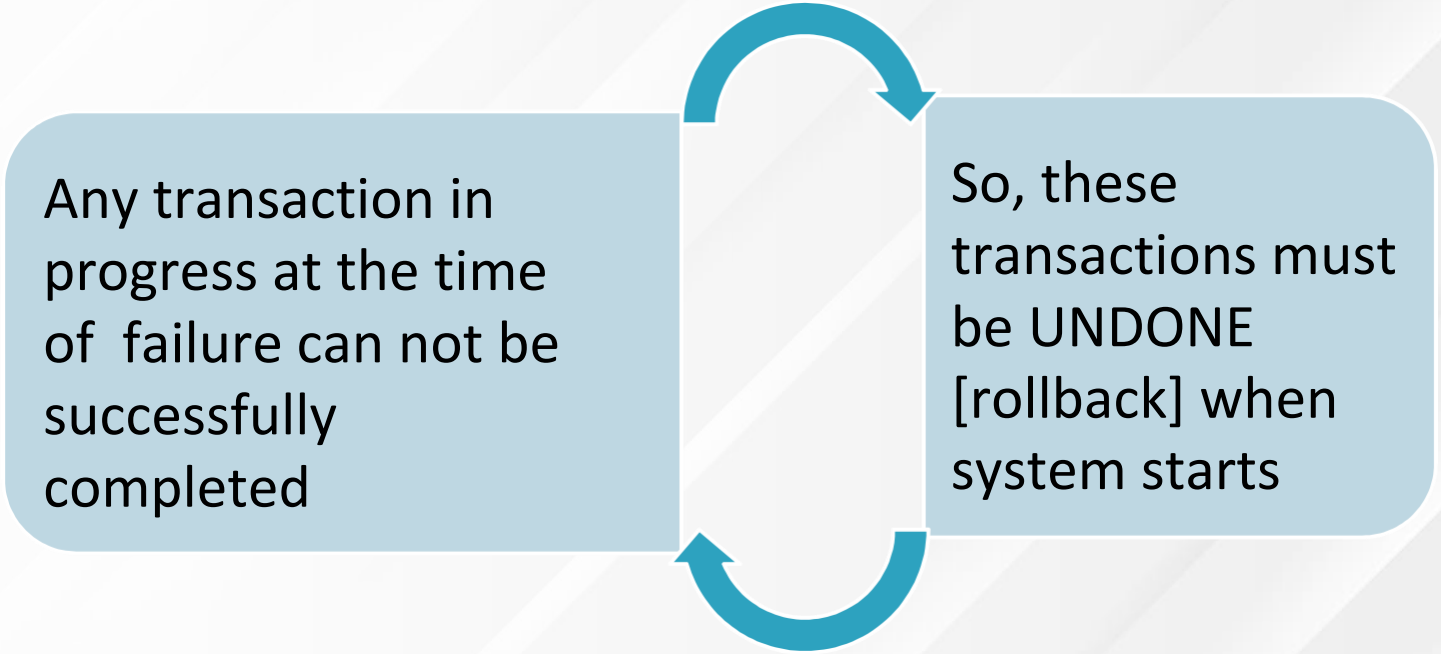
Techniques for Recovery



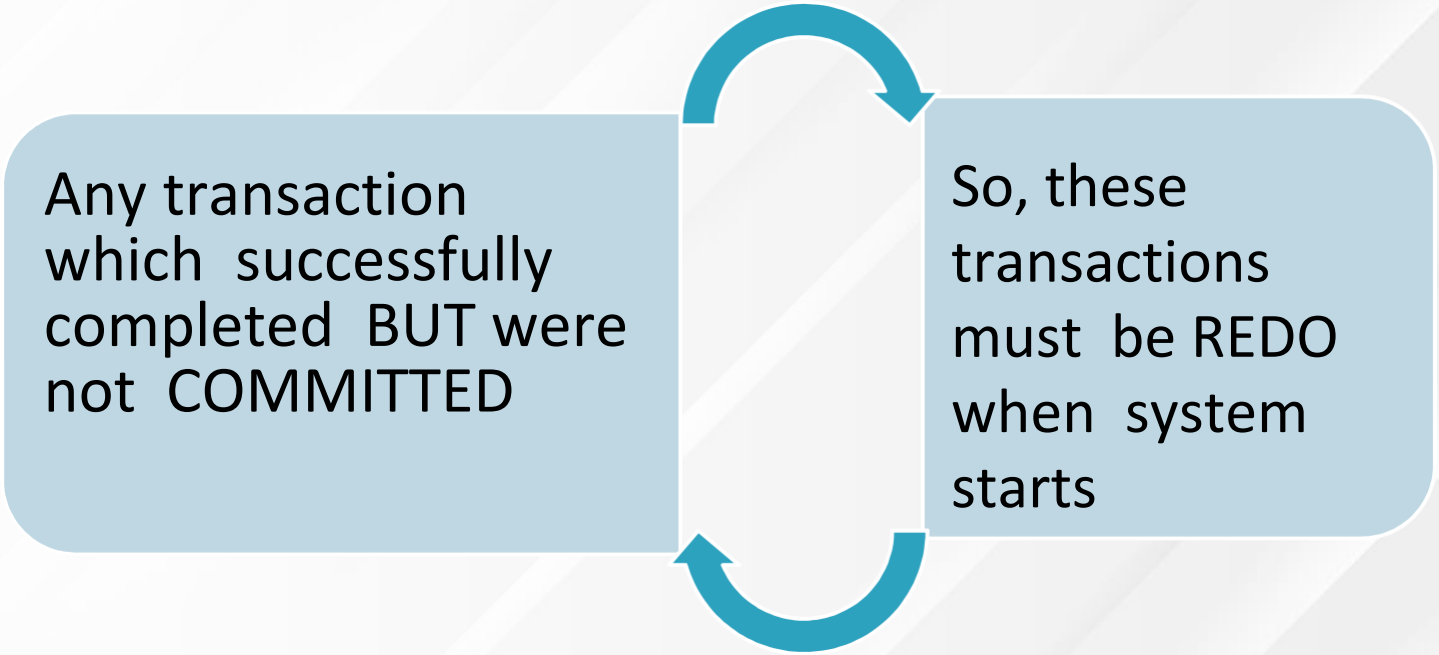
Key Point about System Failure

System Failure results in loss of content of Main Memory [Database Buffer]

Key Points


Any transaction in progress at the time of failure can not be successfully completed
So, these transactions must be UNDONE [rollback] when system starts

Key Points


Any transaction which successfully completed BUT were not COMMITTED
So, these transactions must be REDO when system starts

Checkpoint

Log Files may also contain CHECKPOINT records

CHECKPOINT is a certain prescribed or scheduled time interval system that takes

At save point

Physically writes the content of database buffer to physical database

Physically writes a special checkpoint record to the log

Checkpoint record gives a list of transactions in progress at the time the savepoint is taken

Deferred Update

Under this recovery protocol, UPDATES are not WRITTEN to database until TRANSACTION has reached its COMMIT point

If TRANSACTION fails before reaching its COMMIT point, it doesn't modify database, hence NO action is needed.

If SYSTEM FAILURE occurs after COMMIT point, REDO the updates of COMMITTED TRANSACTION

Intermediate Update

- Under this recovery protocol, UPDATES are WRITTEN to the database immediately without waiting to reach the COMMIT point
- If TRANSACTION fails, the system should UNDO the updates made by TRANSACTION not COMMITTED at the time of failure.
- May be necessary to REDO the updates of COMMITTED TRANSACTIONS

Intermediate Update – Key Operations

REDO

- Transaction which completed successfully before the crash/failure

UNDO

- Transaction which started but did not complete before the crash/failure

Intermediate Update – Process

UNDO List

- If begin transaction is found
- Backward Direction

REDO List

- If commit is found, move from UNDO to REDO
- Forward Direction

Intermediate Update - Example

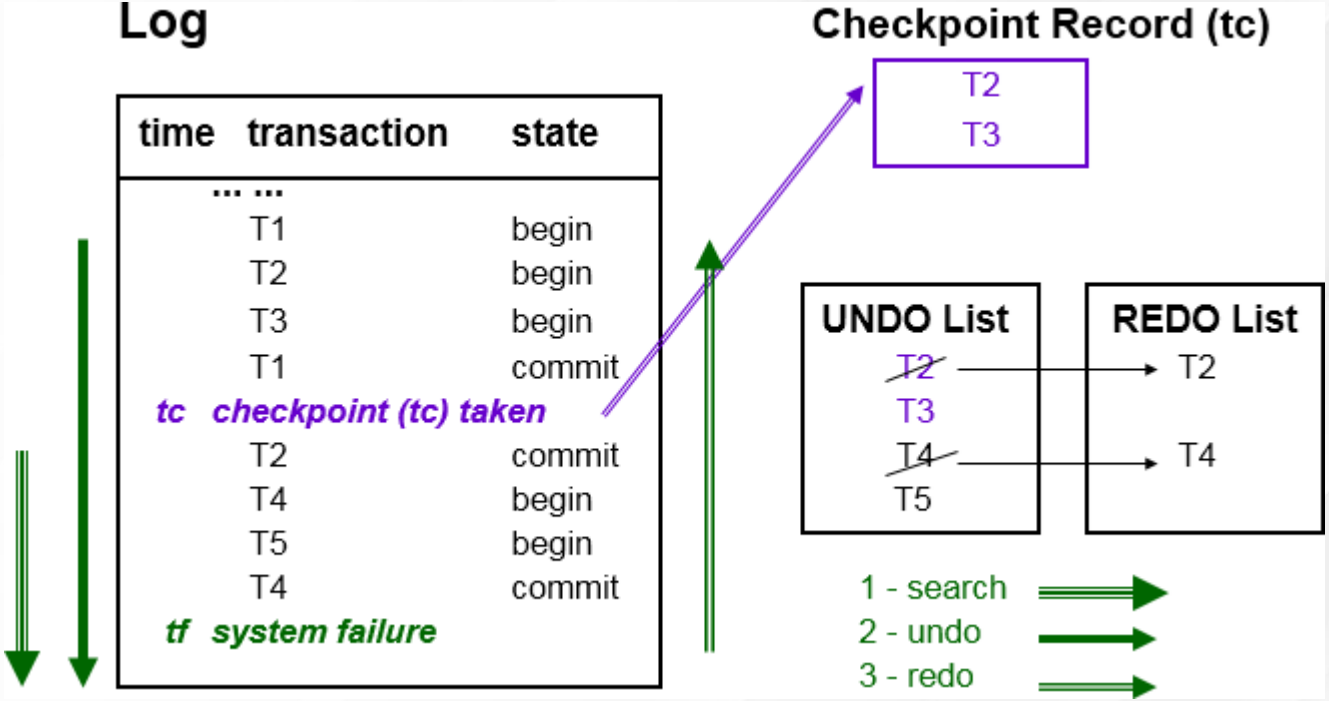
Log

time	transaction	state
	... ...	
	T1	begin
	T2	begin
	T3	begin
	T1	commit
tc	*checkpoint (tc) taken*	
	T2	commit
	T4	begin
	T5	begin
	T4	commit
tf	*system failure*	

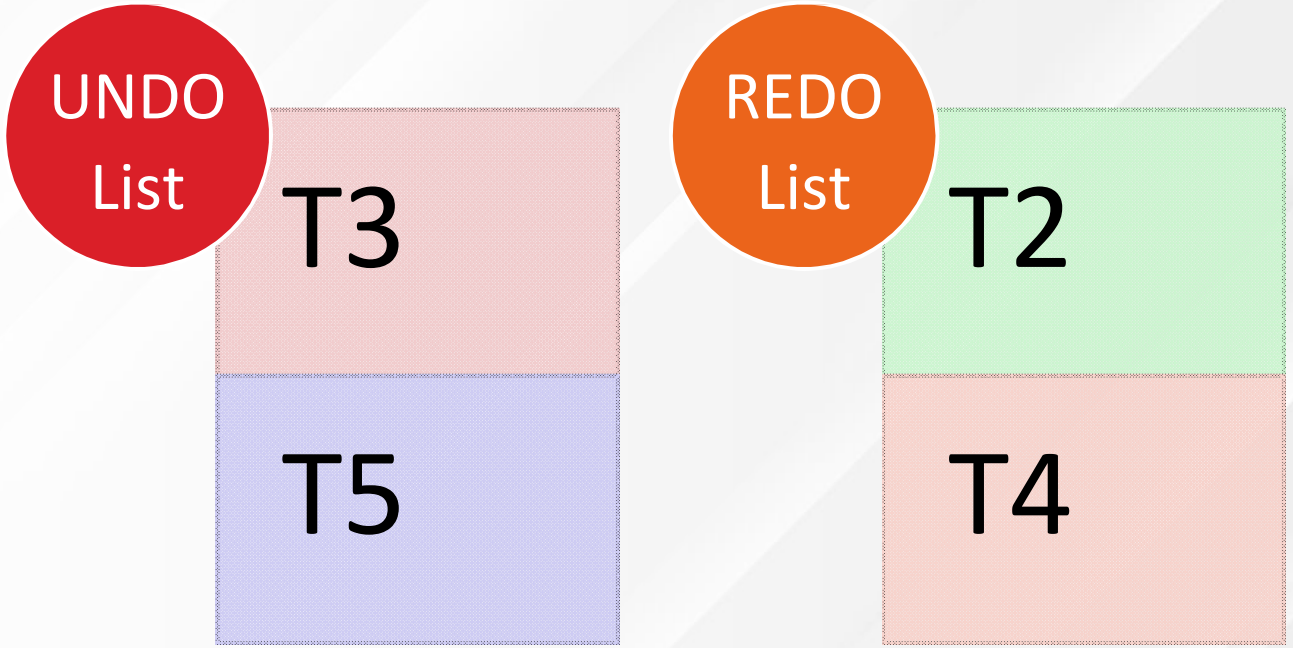
Checkpoint Record (tc)

T2
T3

Intermediate Update - Example

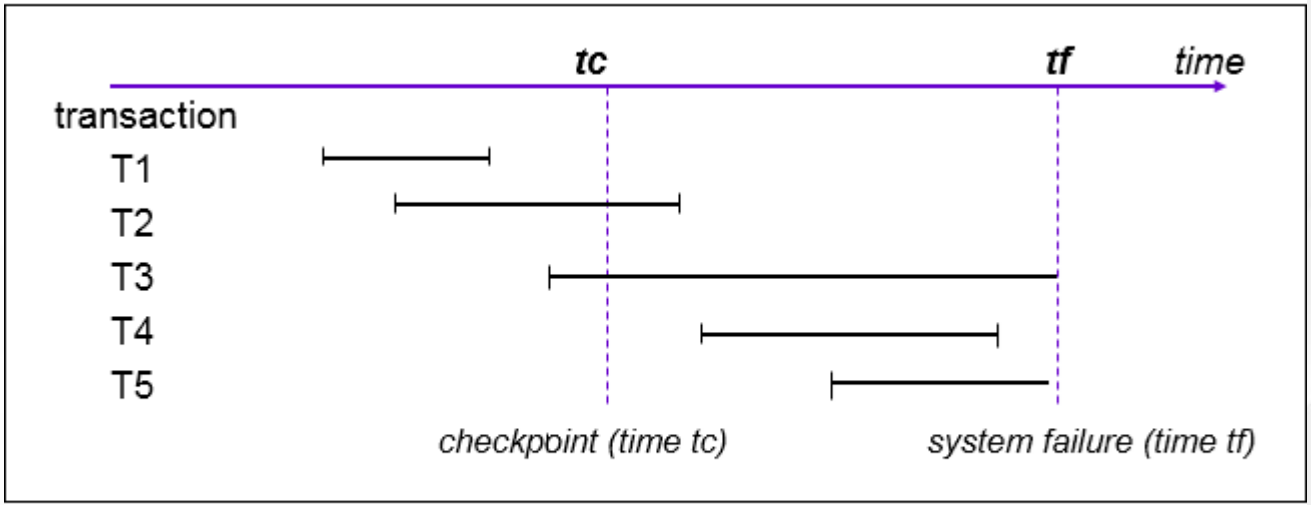


Intermediate Update - Solution



Intermediate Update - Question

Consider the various transactions in the case:

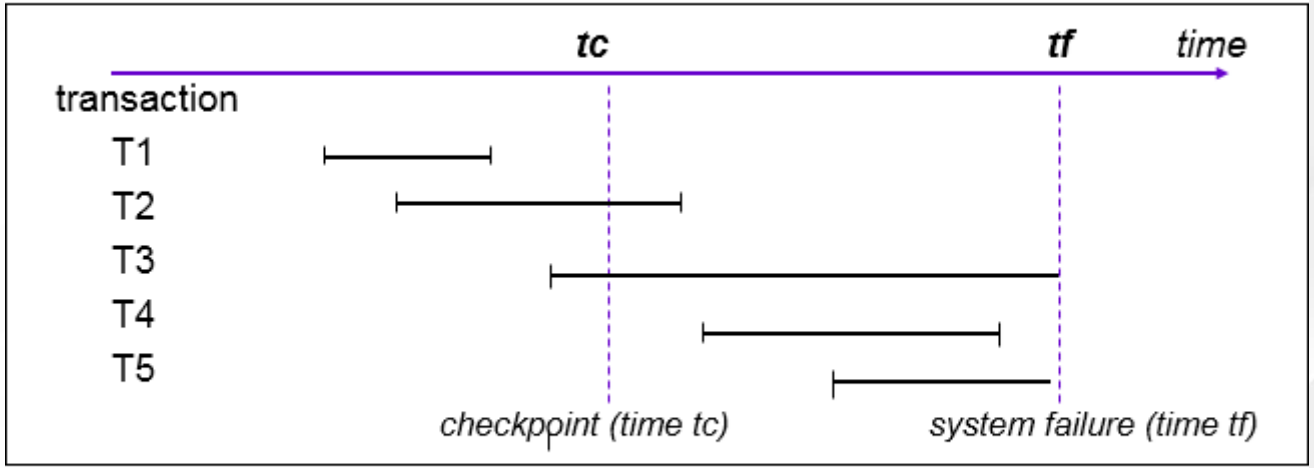


Question:

Which transaction(s) need to be undone, redone, or done nothing?

Intermediate Update - Question

Answer:



REDO: T2, T4

UNDO: T3, T5

Do nothing: T1

Shadow Paging

No UNDO

No REDO

approach to

RECOVERY

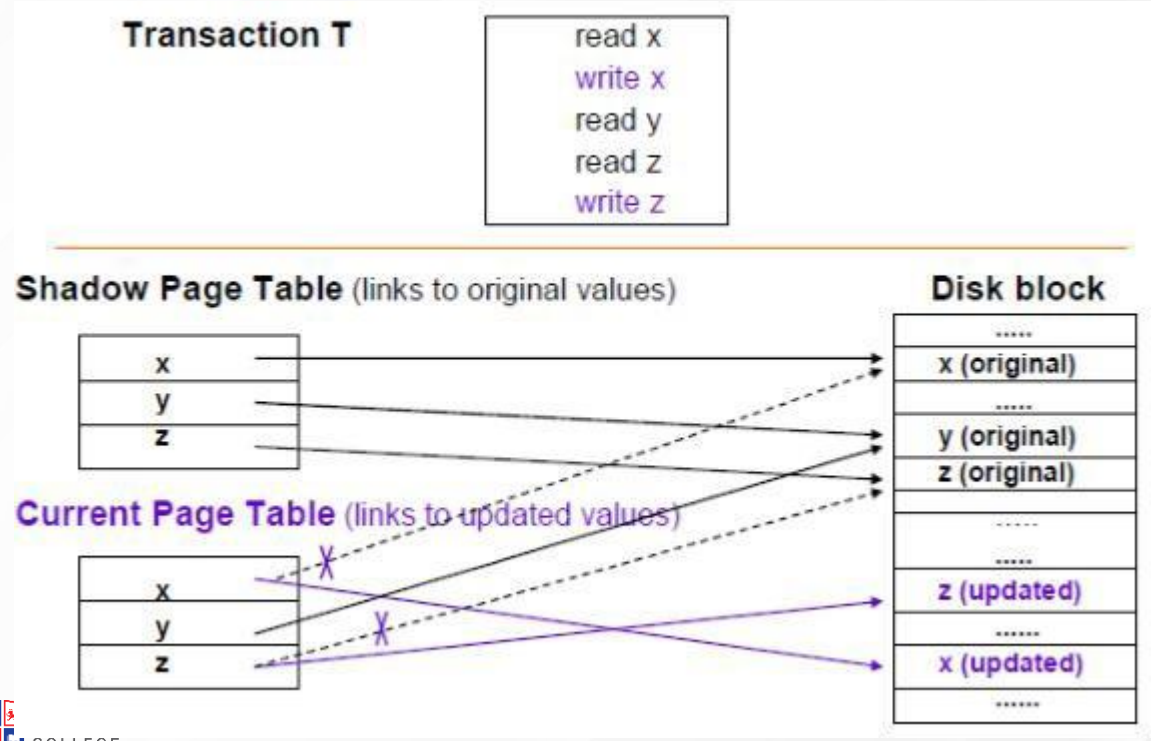
Shadow Paging - Idea

- Database is partitioned into fixed-length blocks referred to as PAGES.
- Page table contains n entries
- Maintain 2 pages tables during life of transaction
  - The current page table
  - The shadow page table

Shadow Paging - Process

- When transaction starts BOTH page tables are IDENTICAL
- The SHADOW page is NEVER changed over the duration of transaction
- The CURRENT page table may be changed when transaction performs WRITE operation

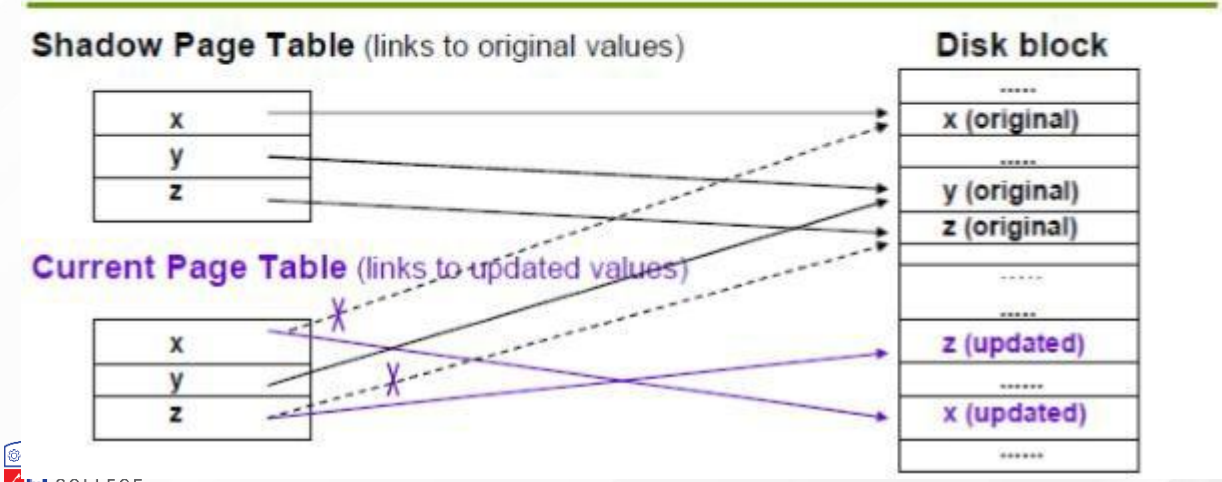
Shadow Paging - Example



Shadow Paging - Example

At commit:- delete shadow page table
current page table becomes new 'shadow' page table

At failure:- delete current page table
shadow page table provides the original data values



SUMMARY

- Importance of Database Recovery
- Principles of Database Recovery
- Concepts of Transaction
- Role of LOG File
- Three Types of Failures
- Recovery Techniques for System Failure

Thank You